OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **LAKE WINNISQUAM, POT ISLAND** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *stable* in-lake chlorophyll-a trend. Chlorophyll concentration increased slightly this season with a slight increase in phosphorus concentration. Chlorophyll concentration has remained well below the NH mean reference line for 13 years! While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are internal and external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *slightly improving, yet stable* trend in lake transparency. Water clarity continues to be high at Pot Island, and remains well above the average for NH lakes. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stabilizing* trend for in-lake

phosphorus levels. Epilimnetic phosphorus concentration increased slightly from last season, but remained at a healthy level. Hypolimnetic phosphorus concentration was slightly elevated in August, but remained below the NH median. Mean phosphorus concentration has remained below the NH median since 1987 in the epilimnion and 1991 in the hypolimnion. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Phosphorus concentration in Black Bk. decreased this season (Table 8). The increased rainfall helped to increase the flow of the brook, which led to less turbid samples (Table 11). The decrease in organic material in the samples led to the reduction in phosphorus levels from the 1999 season.

- **Please note** in July this summer phosphorus levels were found to be less than 5 µg/L in the epilimnion and Winnipesaukee River. The NHDES Laboratory Services adopted a new method of analyzing total phosphorus this year and the lowest value that can be recorded is 'less than 5 µg/L'. We would like to remind the association that a reading of 5 µg/L is considered low for New Hampshire's waters.

- Dissolved oxygen was again high at all depths of the lake (Table 9). As stratified lakes age, oxygen is depleted in the lower layer by the process of decomposition. The lack of this aging indicator is a sign of the lake's overall health. Since the dissolved oxygen profile was conducted from a shallower depth this season, we recommend starting from the deepest depth so that a better representation of what is occurring closest to the bottom of the lake can be obtained.

- The dominant algae in the lake consisted mainly of a healthy mix of golden-browns and diatoms (Table 2). A small amount of blue-green algae were present in the plankton sample in both July and August. Blue-green algae can reach nuisance levels when sufficient nutrients and favorable environmental conditions are present. While overall algal abundance continues to be low in the lake, the presence of these indicator species should serve as a reminder of the lake's delicate balance. Continued care to protect the watershed by limiting or eliminating fertilizer use on lawns, keeping the lake shoreline natural, and properly maintaining septic systems and roads will keep algae populations in balance.

USEFUL RESOURCES

The Blue Green Algae. North American Lake Management Society, 1989. (608) 233-2836 or www.nalms.org

A Boater's Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503 or www.state.nh.us

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

The Watershed Guide to Cleaner Rivers, Lakes, and Streams, Connecticut River Joint Commissions, 1995. (603) 826-4800

Erosion on Shorefront Property, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

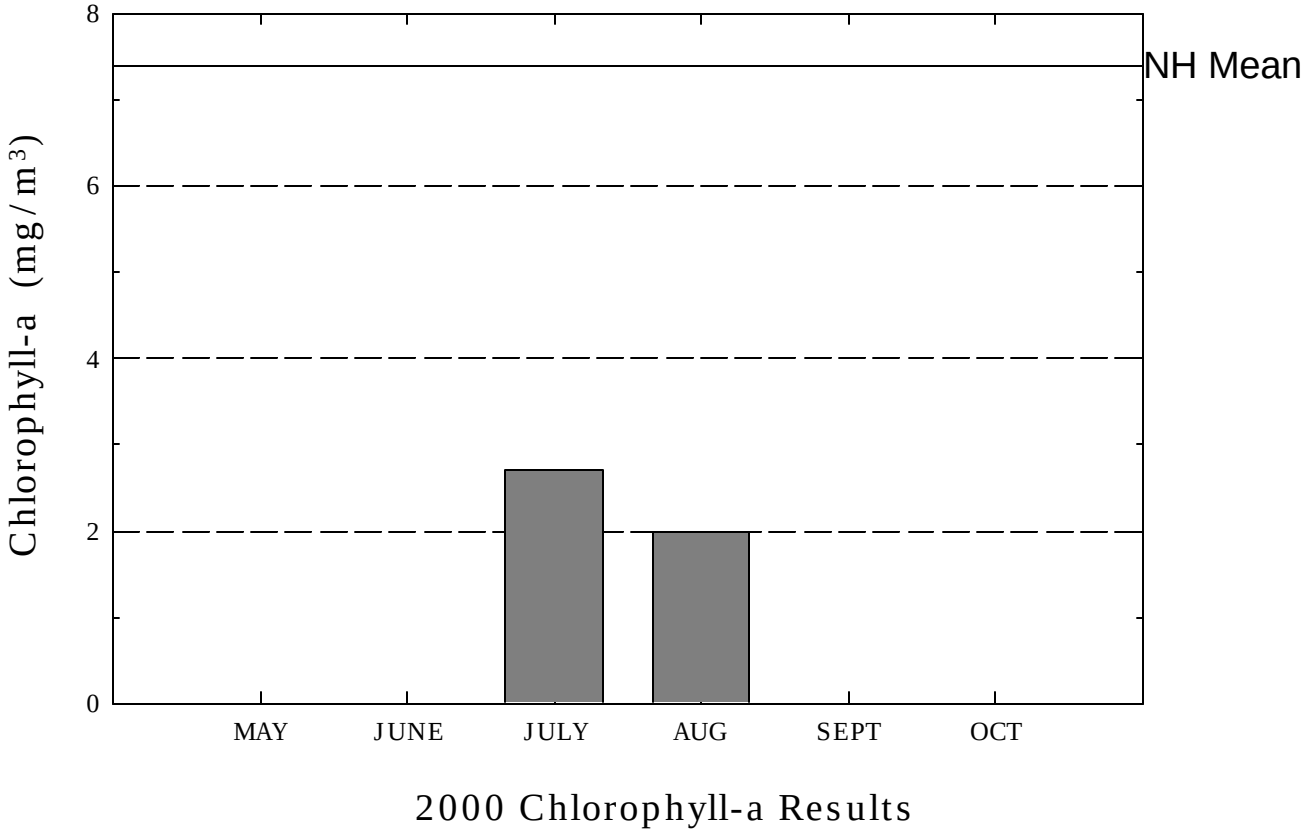
Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

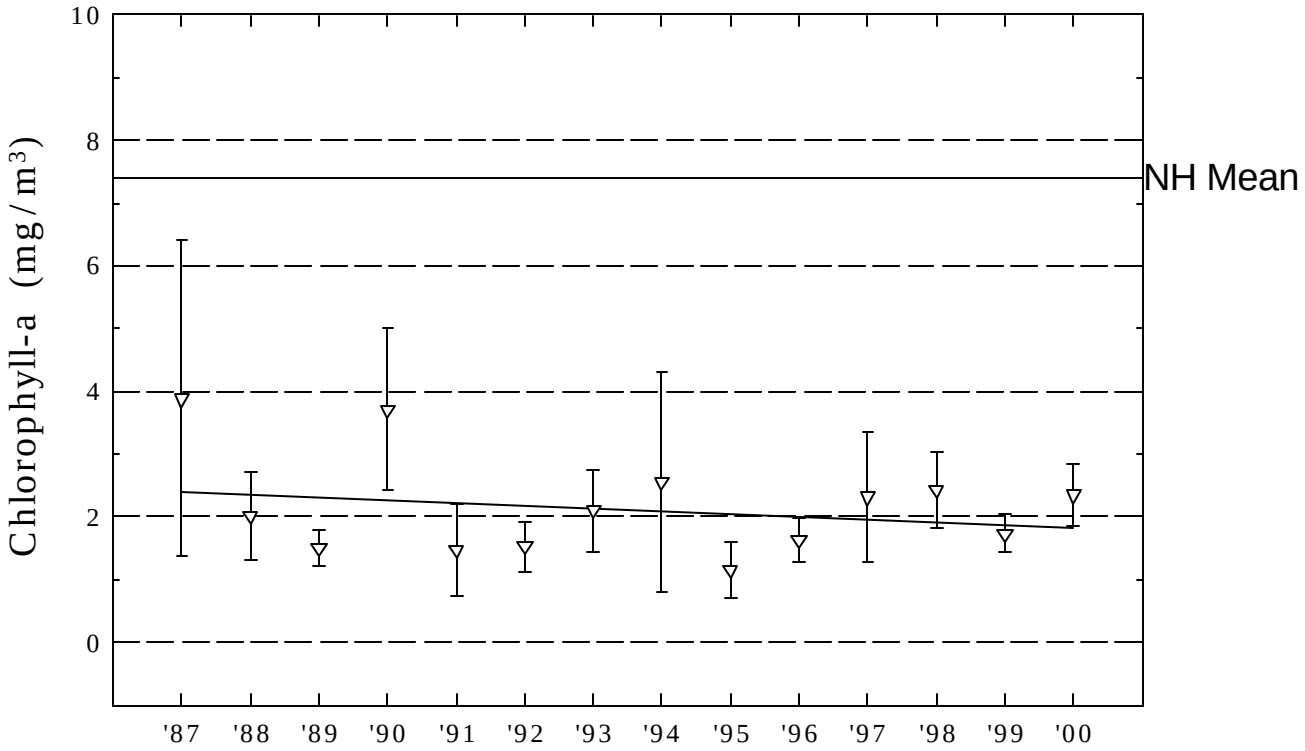
Guidelines for Redeveloping Shoreland Property, WD-BB-33, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

Lake Winnisquam, Pot Island

Figure 1. Monthly and Historical Chlorophyll-a Results



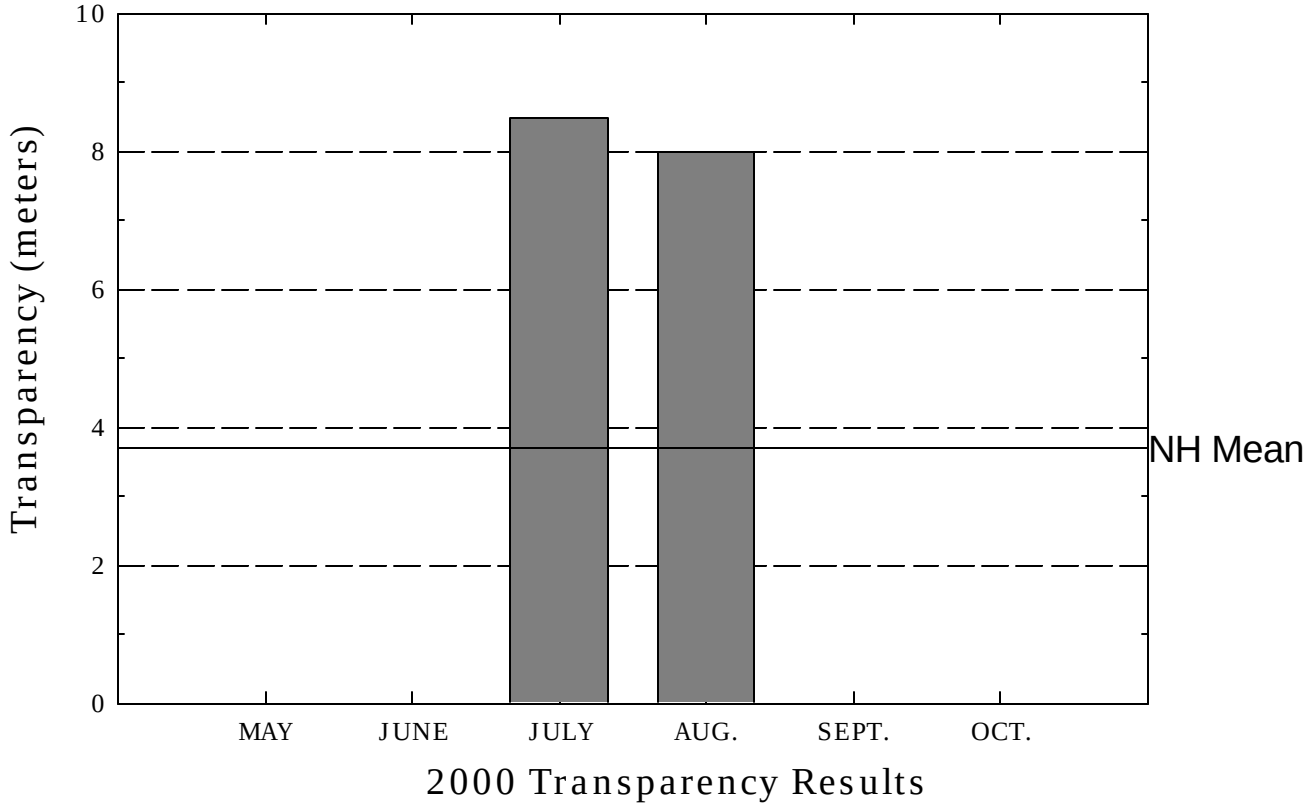
2000 Chlorophyll-a Results

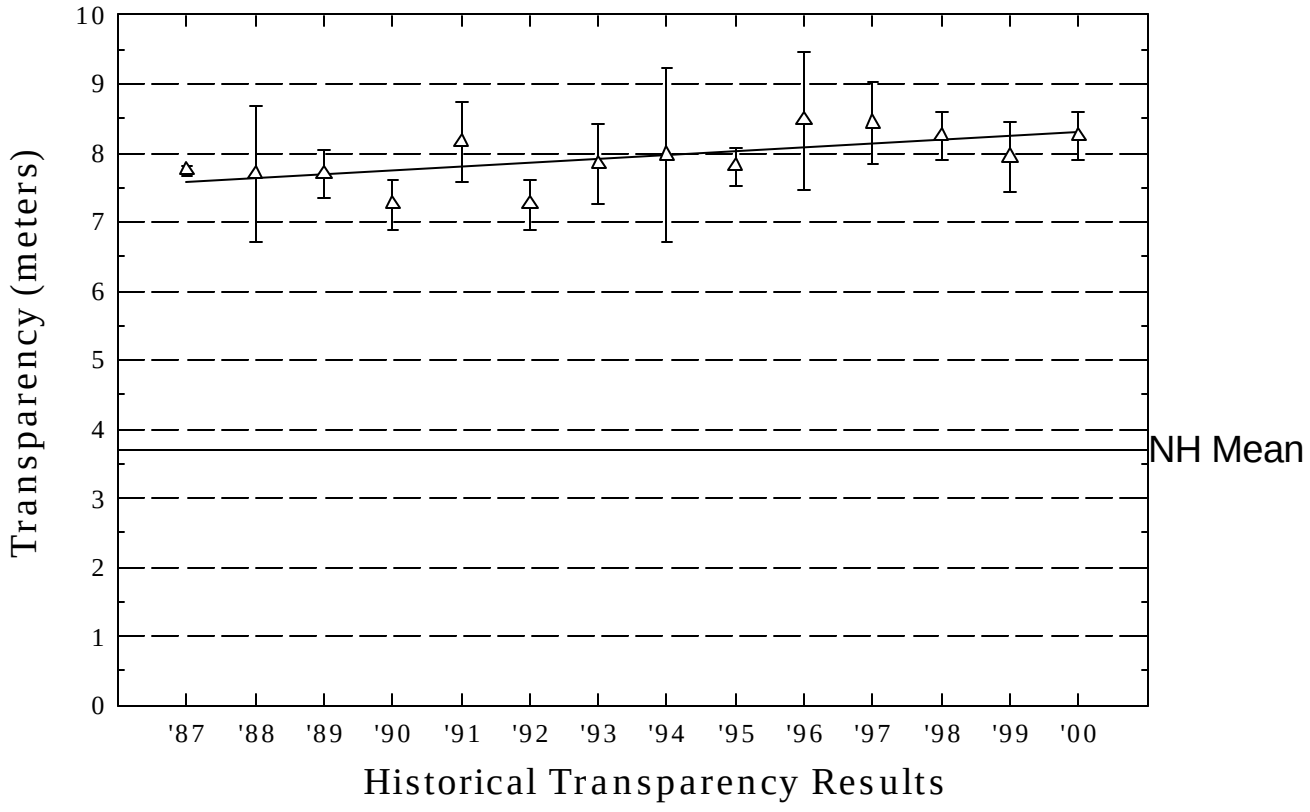


Historical Chlorophyll-a Results

Lake Winnisquam, Pot Island

Figure 2. Monthly and Historical Transparency Results





Lake Winnisquam, Pot Island

Figure 3. Monthly and Historical Total Phosphorus Data.

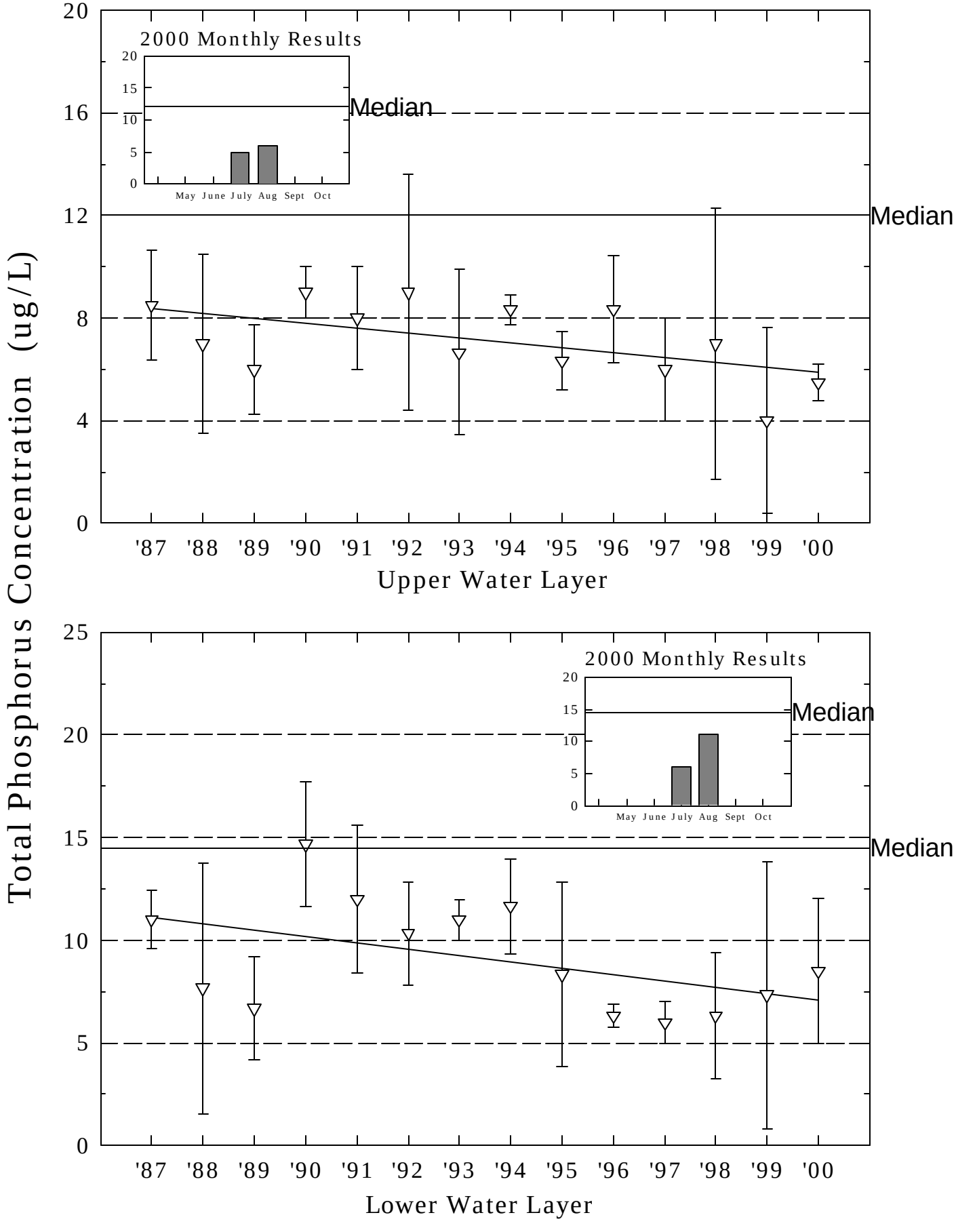


Table 1.

WINNISQUAM, POT ISL.
LACONIA

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1987	2.10	5.66	3.88
1988	1.39	2.78	2.01
1989	1.26	1.83	1.50
1990	2.56	5.10	3.51
1991	0.92	2.32	1.48
1992	1.09	1.85	1.53
1993	1.44	2.75	2.10
1994	1.47	4.59	2.56
1995	0.74	1.64	1.04
1996	1.26	1.99	1.63
1997	1.64	3.49	2.31
1998	1.99	3.13	2.43
1999	1.42	2.01	1.73
2000	1.99	2.70	2.34

Table 2.

WINNISQUAM, POT ISL.

LACONIA

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
07/20/1987	TABELLARIA	21
	CERATIUM	18
	DINOBRYON	16
07/28/1988	DINOBRYON	55
		19
07/14/1989	DINOBRYON	33
	ASTERIONELLA	30
	TABELLARIA	
07/05/1990	TABELLARIA	46
	DINOBRYON	21
	CHRYSOSPHAERELLA	10
07/19/1991	ASTERIONELLA	69
	DINOBRYON	12
	STAURASTRUM	7
08/09/1992	DINOBRYON	37
	STAURASTRUM	16
	COSMARIUM	11
07/10/1993	TABELLARIA	44
07/20/1994	DINOBRYON	34
	TABELLARIA	22
07/14/1996	RHIZOSOLENIA	72
	SYNEDRA	46
	TABELLARIA	42
07/06/1997	TABELLARIA	75
	DINOBRYON	11
	ASTERIONELLA	5
07/05/1998	DINOBRYON	79
	TABELLARIA	14
	CERATIUM	10

Table 2.

WINNISQUAM, POT ISL.

LACONIA

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
07/05/1999	STAURASTRUM	23
	ARTHRODESMUS	19
	CERATIUM	8
08/15/1999	CHRYSOSPHAERELLA	33
	DINOBRYON	21
	TABELLARIA	10
09/06/1999	CHRYSOSPHAERELLA	30
	ANABAENA	11
	APHANIZOMENON	9
07/14/2000	SYNURA	38
	DINOBRYON	32
	ASTERIONELLA	11

Table 3.

WINNISQUAM, POT ISL.
LACONIA

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1987	7.7	7.8	7.7
1988	7.0	8.4	7.7
1989	7.5	8.1	7.7
1990	7.0	7.5	7.3
1991	7.5	8.5	8.1
1992	7.0	7.5	7.2
1993	7.5	8.5	7.8
1994	7.0	9.4	7.9
1995	7.6	8.0	7.8
1996	7.5	9.5	8.4
1997	7.8	9.0	8.4
1998	8.0	8.5	8.2
1999	7.5	8.5	7.9
2000	8.0	8.5	8.2

Table 4.

WINNISQUAM, POT ISL.

LACONIA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
BLACK BK				
	1987	6.64	7.14	6.82
	1988	5.72	7.05	6.12
	1989	6.70	7.05	6.87
	1990	6.63	6.70	6.65
	1991	6.70	6.70	6.70
	1992	6.64	7.06	6.83
	1993	6.56	7.02	6.78
	1994	6.52	6.89	6.66
	1995	6.83	7.11	6.95
	1996	6.12	6.76	6.42
	1997	6.65	6.97	6.80
	1998	6.06	6.87	6.37
	1999	6.22	6.54	6.37
	2000	6.86	6.88	6.87
CHAPMAN BK				
	1987	6.83	6.83	6.83
EPILIMNION				
	1987	7.04	7.15	7.09
	1988	6.66	7.28	6.94
	1989	7.09	7.23	7.16
	1990	6.86	6.94	6.89
	1991	6.89	7.20	7.07
	1992	7.13	7.22	7.18
	1993	6.85	7.25	7.06

Table 4.

WINNISQUAM, POT ISL.

LACONIA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1994	7.05	7.15	7.09
	1995	7.08	7.28	7.19
	1996	6.69	6.86	6.77
	1997	6.88	7.03	6.96
	1998	6.95	6.99	6.97
	1999	6.62	7.25	6.80
	2000	6.98	7.03	7.00
HYPOLIMNION				
	1987	6.47	6.60	6.53
	1988	6.28	7.16	6.51
	1989	6.50	7.06	6.68
	1990	6.36	6.53	6.46
	1991	6.50	6.60	6.54
	1992	6.56	6.76	6.65
	1993	6.41	6.50	6.46
	1994	6.49	6.59	6.54
	1995	6.43	6.57	6.51
	1996	6.30	6.46	6.39
	1997	6.60	6.87	6.70
	1998	6.29	6.48	6.40
	1999	6.28	6.61	6.41
	2000	6.52	6.63	6.57
MCLAUGHLIN HOUSE				
	1997	8.00	8.00	8.00

Table 4.

WINNISQUAM, POT ISL.

LACONIA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1987	6.97	7.05	7.01
	1988	6.28	6.98	6.58
	1989	6.76	7.09	6.90
	1990	6.55	6.70	6.65
	1991	6.62	7.10	6.88
	1992	6.83	7.02	6.91
	1993	6.80	6.99	6.86
	1994	6.79	7.03	6.93
	1995	6.71	6.99	6.81
	1996	6.34	6.69	6.52
	1997	6.76	6.94	6.82
	1998	6.56	7.01	6.68
	1999	6.57	6.77	6.65
	2000	6.65	6.89	6.75
WINNIPESAUKEE RIVER				
	1987	6.82	6.99	6.91
	1988	6.64	7.11	6.88
	1989	7.00	7.12	7.07
	1990	6.69	7.17	6.88
	1991	6.90	7.20	7.02
	1992	7.09	7.29	7.15
	1993	6.87	7.04	6.98
	1994	6.81	7.08	6.96
	1995	7.21	7.23	7.22
	1996	6.76	6.80	6.78

Table 4.

WINNISQUAM, POT ISL.

LACONIA

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1997	6.71	7.10	6.92
	1998	6.83	6.95	6.87
	1999	6.62	7.00	6.73
	2000	6.97	7.00	6.98

Table 5.

WINNISQUAM, POT ISL.

LACONIA

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1987	7.00	7.00	7.00
1988	5.90	7.60	6.87
1989	6.10	6.70	6.43
1990	6.30	7.10	6.83
1991	6.70	7.40	7.03
1992	6.20	7.70	7.07
1993	6.50	6.90	6.67
1994	7.10	7.80	7.43
1995	8.30	9.30	8.63
1996	5.80	7.10	6.57
1997	6.70	7.20	6.87
1998	5.70	7.00	6.17
1999	6.70	7.90	7.10
2000	7.00	7.30	7.15

Table 6.

WINNISQUAM, POT ISL.
LACONIA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
BLACK BK				
	1987	65.5	66.4	65.9
	1988	69.4	71.2	70.2
	1989	68.9	71.1	70.2
	1990	58.7	74.5	69.4
	1991	74.5	74.7	74.6
	1992	74.3	80.3	76.9
	1993	76.0	79.4	77.6
	1994	79.6	83.6	81.1
	1995	75.5	83.4	79.4
	1996	60.6	73.9	68.8
	1997	73.6	76.3	74.7
	1998	47.9	68.5	60.8
	1999	68.4	88.8	81.0
	2000	78.5	81.3	79.9
CHAPMAN BK				
	1987	66.8	66.8	66.8
EPILIMNION				
	1987	64.7	65.8	65.2
	1988	68.7	69.4	69.1
	1989	68.0	71.5	69.3
	1990	70.5	72.8	71.6
	1991	63.1	73.4	69.5
	1992	74.6	77.1	75.5
	1993	75.2	76.2	75.5

Table 6.

WINNISQUAM, POT ISL.
LACONIA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1994	76.2	76.7	76.5
	1995	76.6	77.7	77.0
	1996	71.8	74.4	72.8
	1997	72.0	73.1	72.6
	1998	66.6	69.4	67.7
	1999	77.1	78.7	77.7
	2000	80.7	81.9	81.3
HYPOLIMNION				
	1987	66.4	66.6	66.5
	1988	67.4	69.4	68.3
	1989	69.2	75.6	73.2
	1990	73.6	73.8	73.7
	1991	71.7	71.9	71.8
	1992	75.1	76.7	75.6
	1993	71.6	77.0	75.0
	1994	77.0	80.4	79.0
	1995	75.6	79.4	77.6
	1996	74.7	76.4	75.5
	1997	71.9	72.7	72.4
	1998	76.2	77.5	77.0
	1999	76.9	78.2	77.6
	2000	83.1	83.6	83.4
MCLAUGHLIN HOUSE				
	1997	171.2	171.2	171.2

Table 6.

WINNISQUAM, POT ISL.
LACONIA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
METALIMNION				
	1987	65.6	66.4	66.0
	1988	68.3	70.4	69.3
	1989	71.6	74.0	73.2
	1990	70.6	73.6	72.4
	1991	71.5	72.8	72.3
	1992	70.2	76.7	74.1
	1993	73.0	77.6	75.6
	1994	77.3	77.9	77.7
	1995	76.0	76.9	76.4
	1996	73.3	74.6	74.0
	1997	71.5	71.8	71.6
	1998	69.1	70.4	69.7
	1999	77.4	78.8	78.2
	2000	81.9	82.1	82.0
WINNIPESAUKEE RIVER				
	1987	59.4	62.4	61.0
	1988	64.4	66.9	65.7
	1989	65.4	67.1	66.1
	1990	67.2	68.8	68.1
	1991	69.1	70.2	69.6
	1992	70.4	75.8	72.6
	1993	72.4	75.6	74.2
	1994	73.2	74.5	73.9
	1995	71.5	72.7	72.1

Table 6.

WINNISQUAM, POT ISL.
LACONIA

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1996	68.6	72.4	70.9
	1997	69.0	74.7	71.1
	1998	63.7	73.4	68.9
	1999	73.8	76.7	74.9
	2000	74.5	78.0	76.2

Table 8.

WINNISQUAM, POT ISL.

LACONIA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
BLACK BK				
	1987	19	20	19
	1988	15	22	18
	1989	7	15	10
	1990	8	18	13
	1991	13	18	15
	1992	7	16	10
	1993	8	9	8
	1994	15	23	19
	1995	9	16	12
	1996	4	13	9
	1997	8	10	8
	1998	8	30	16
	1999	6	20	14
	2000	7	11	9
CHAPMAN BK				
	1987	9	9	9
EPILIMNION				
	1987	< 10	10	8
	1988	3	9	7
	1989	4	7	6
	1990	8	10	8
	1991	6	10	8
	1992	5	14	9
	1993	3	9	6

Table 8.

WINNISQUAM, POT ISL.

LACONIA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1994	8	9	8
	1995	5	7	6
	1996	6	10	8
	1997	4	8	6
	1998	1	11	7
	1999	1	8	4
	2000	< 5	6	5
HYPOLIMNION				
	1987	10	12	11
	1988	< 1	13	7
	1989	4	9	6
	1990	12	18	15
	1991	9	16	12
	1992	8	13	10
	1993	10	12	11
	1994	9	13	11
	1995	4	13	8
	1996	6	7	6
	1997	5	7	6
	1998	3	9	6
	1999	1	14	7
	2000	6	11	8
METALIMNION				
	1987	< 10	10	9
	1988	4	12	9

Table 8.

WINNISQUAM, POT ISL.

LACONIA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1989	7	10	8
	1990	10	16	14
	1991	7	10	8
	1992	7	10	8
	1993	7	12	9
	1994	10	14	12
	1995	9	10	9
	1996	8	13	10
	1997	7	10	8
	1998	2	8	5
	1999	5	11	7
	2000	5	9	7
WINNIPESAUKEE RIVER				
	1987	10	11	10
	1988	< 1	8	3
	1989	6	8	6
	1990	6	10	7
	1991	3	8	5
	1992	5	6	5
	1993	6	8	7
	1994	6	7	6
	1995	7	19	13
	1996	3	6	4
	1997	5	10	7
	1998	1	8	5
	1999	3	7	4

Table 8.

WINNISQUAM, POT ISL.

LACONIA

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	2000	< 5	6	5

Table 9.

WINNISQUAM, POT ISL.

LACONIA

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
		August 13, 2000	
0.1	22.9	7.8	88.0
1.0	22.9	7.8	88.0
3.0	22.8	7.8	88.0
5.0	22.7	7.7	87.0
6.0	22.6	7.7	87.0
8.0	22.0	8.7	98.0
9.0	17.5	8.8	90.0
10.0	15.3	8.4	83.0
11.0	12.8	7.6	70.0
12.0	11.6	7.5	67.0
13.0	11.0	7.4	67.0
14.0	10.3	7.4	65.0
15.0	9.4	7.6	65.0
17.0	8.8	7.5	63.0
19.0	8.1	7.7	64.0
21.0	7.9	7.8	63.0
23.0	7.7	7.8	63.0
25.0	7.6	7.9	64.0
28.0	7.5	7.8	63.0
32.0	7.3	7.8	63.0
33.0	7.3	7.8	63.0
35.0	7.3	7.7	62.0
37.0	7.3	7.8	63.0
40.0	7.3	7.9	64.0
42.0	7.2	7.7	62.0

Table 10.

WINNISQUAM, POT ISL.

LACONIA

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
July 20, 1987	30.0	7.0	9.2	75.0
July 28, 1988	43.0	6.0	9.3	74.0
July 14, 1989	46.0	6.0	8.8	69.0
July 5, 1990	53.0	6.0	9.4	75.3
August 15, 1991	44.0	6.9	8.6	70.4
July 19, 1992	49.6	6.5	8.7	70.5
July 10, 1993	50.0	6.9	9.3	74.0
July 20, 1994	45.0	7.0	8.8	71.0
August 15, 1995	44.0	7.1	7.3	60.0
July 14, 1996	50.0	6.0	10.0	80.0
July 6, 1997	52.0	7.3	9.1	75.0
July 19, 1998	50.0	7.4	4.2	33.0
July 5, 1999	56.0	7.1	1.0	8.0
August 13, 2000	42.0	7.2	7.7	62.0

Table 11.

WINNISQUAM, POT ISL.
LACONIA

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
BLACK BK				
	1997	0.5	0.6	0.5
	1998	0.6	3.9	1.7
	1999	0.9	3.0	2.0
	2000	0.7	0.7	0.7
EPILIMNION				
	1997	0.2	0.2	0.2
	1998	0.3	0.6	0.4
	1999	0.2	0.2	0.2
	2000	0.2	0.2	0.2
HYPOLIMNION				
	1997	0.2	0.4	0.3
	1998	0.1	0.6	0.4
	1999	0.2	0.3	0.3
	2000	0.3	0.4	0.3
MCLAUGHLIN HOUSE				
	1997	0.5	0.5	0.5
METALIMNION				
	1997	0.2	0.3	0.3
	1998	0.2	0.4	0.3
	1999	0.2	0.3	0.3
	2000	0.2	0.4	0.3
WINNIPESAUKEE RIVER				
	1997	0.3	0.3	0.3
	1998	0.4	0.9	0.7
	1999	0.3	0.4	0.3

Table 11.

WINNISQUAM, POT ISL.
LACONIA

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
	2000	0.2	0.2	0.2